

REMARKS

The Office Action of June 19, 2009 has been carefully reviewed. The Applicants respectfully request the Examiner to reconsider the rejections and allow the pending claims in view of the following remarks.

Claims 1-10 are pending. Claims 11-39 are withdrawn from consideration. Claims 1-10 stand rejected. Claim 1 is hereby amended.

Specification

Paragraphs [0036], [0039], [0067], and [0069] of the specification have been amended to correct typographical errors and inconsistencies in the specification. No new matter is contained in these amendments.

Abstract

The abstract was objected to as referring to both the purported merits of the invention and the speculative applications thereof. The abstract has been amended as suggested by the Examiner.

Drawings

The Examiner objected to Figures 7, 9, 11, and 13 because reference characters “43” and “44” were both identified as designating a molded article and because reference character “41” was used to designate both “molding machine” and “mold.” The specification has been amended to remove uses of reference character “41” to designate “mold.” Replacement drawings, which correct the deficiencies, are attached hereto. No new matter is contained in these amendments.

Rejection of Claims

In the Office Action mailed June 19, 2009, the Examiner rejected claims 1, 5-6, and 10 under 35 USC §102(b) as being anticipated by U.S. Patent No. 5,294,394 (*Sakai et al.*). Claims 5-6, and 10 depend, either directly or indirectly, from independent claim 1. Thus, claims 1, 5-6, and 10 stand or fall on the application of *Sakai et al.* to independent claim 1. According to MPEP §

2131, “[a] claim is anticipated only if **each and every element** as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” Applicants respectfully submit that *Sakai et al.* fails to disclose each and every element of amended independent claim 1.

Specifically, Applicants submit that *Sakai et al.* fails to disclose the element that ***the continuous reinforcing fiber-impregnated prepreg layer is formed in a tape or strand shape by drawing and pressing fibers passed through an impregnation die supplied with a thermoplastic resin melt.*** Amended independent claim 1 reads:

1. A thermoplastic composite sheet comprising:
a center layer made of a thermoplastic composite material containing thermoplastic resin; and

a continuous reinforcing fiber-impregnated prepreg layer laminated on at least one surface of the upper surface and lower surface of the center layer, the prepreg layer comprising 5-65% by weight of reinforcing fibers and 35-95% by weight of thermoplastic resin,

wherein the continuous reinforcing fiber-impregnated prepreg layer is formed in a tape or strand shape by drawing and pressing fibers passed through an impregnation die supplied with a thermoplastic resin melt.

See supra (emphasis added). As shown above, independent claim 1 has been amended to recite the limitation that ***the continuous reinforcing fiber-impregnated prepreg layer is formed in a tape or strand shape by drawing and pressing fibers passed through an impregnation die supplied with a thermoplastic resin melt.*** Support for the amendment is found in the specification. See Application at [0038]. To the contrary, *Sakai et al.* states:

The sheet prepreg containing the cloth was prepared according to the description in Japanese Patent Laid-Open No. 61-229535 (1986). That is, a cloth of 200 mm in width was rolled, brought into contact with heat-melted thermoplastic resin under tension, and impregnated with the resin by wiping between hot rolls to obtain the sheet prepreg.

Sakai et al. at col. 7, lines 6-12. *Sakai et al.* discloses that the prepreg was prepared according to the description in JP 61-229353 (1986). According to JP 61-229353, the thermoplastic resin is molten in an extruding machine to extrude it from a die provided at the tip end of the extruding machine and coat it on the surface of a heated resin coating film providing roll. Thereafter, the

fiber sheet contacts with the roll, and the resin is impregnated between fibers (see JP 61-229353 at Abstract).

Thus, *Sakai et al.* discloses preparing the sheet prepreg by bringing a cloth into contact with a heat-melted thermoplastic resin and impregnating the cloth with the resin by wiping between hot rolls. Therefore, *Sakai et al.* cannot disclose the element that *the continuous reinforcing fiber-impregnated prepreg layer is formed in a tape or strand shape by drawing and pressing fibers passed through an impregnation die supplied with a thermoplastic resin melt*. As such, *Sakai et al.* cannot anticipate amended independent claim 1 or any claim depending therefrom.

In the Office Action mailed June 19, 2009, the Examiner rejected claims 2 and 8 under 35 USC §103(a) as being unpatentable over *Sakai et al.* in view of U.S. Publication No. 2003/0161989 A1 (*Funakoshi*). Claims 3 and 9 stand rejected under 35 USC §103(a) as being unpatentable over *Sakai et al.* in view of U.S. Patent No. 6,749,934, (*Nagayama et al.*). Claim 4 stands rejected under 35 USC §103(a) as being unpatentable over *Sakai et al.* in view of EP Patent Application No. 0945253 A2 (*Bassett et al.*). Claim 7 stands rejected under 35 USC §103(a) as being unpatentable over *Sakai et al.* Claims 2-4 and 7-9 depend, either directly or indirectly, from independent claim 1. Thus, claims 2-4 and 7-9 stand or fall on the application of the combination of *Sakai et al.* and *Funakoshi*, alternatively, the combination of *Sakai et al.* and *Nagayama et al.*, alternatively, the combination of *Sakai et al.* and *Bassett et al.*, alternatively, the combination of *Sakai et al.* and the knowledge of one of ordinary skill in the art, to independent claim 1. As noted by the United States Supreme Court in *Graham v. John Deere Co. of Kansas City*, an obviousness determination begins with a finding that “the prior art as a whole in one form or another contains all” of the elements of the claimed invention. See *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 22 (U.S. 1966). Applicants respectfully submit that none of the

combination of *Sakai et al.* and *Funakoshi*, the combination of *Sakai et al.* and *Nagayama et al.*, the combination of *Sakai et al.* and *Bassett et al.*, or the combination of *Sakai et al.* and the knowledge of one of ordinary skill in the art, contains all of the elements of amended independent claim 1.

Specifically, Applicants submit that none of the cited combinations contains the element that *the continuous reinforcing fiber-impregnated prepreg layer is formed in a tape or strand shape by drawing and pressing fibers passed through an impregnation die supplied with a thermoplastic resin melt*. As shown above, independent claim 1 has been amended to recite this element. Also shown above, *Sakai et al.* cannot disclose this element. None of *Funakoshi*, *Nagayama et al.*, *Bassett et al.*, or the knowledge of one of ordinary skill in the art is cited as disclosing *the continuous reinforcing fiber-impregnated prepreg layer* and, as such, cannot contain this limitation. Thus, none of the combination of *Sakai et al.* and *Funakoshi*, the combination of *Sakai et al.* and *Nagayama et al.*, the combination of *Sakai et al.* and *Bassett et al.*, or the combination of *Sakai et al.* and the knowledge of one of ordinary skill in the art, contains all of the elements of amended independent claim 1. Therefore, none of the cited combinations can render obvious amended independent claim 1 or any claim depending therefrom.

In addition, the continuous reinforcing fiber-impregnated prepreg layers of the present invention are uniformly, i.e., substantially completely, impregnated with thermoplastic resin while forming continuous fiber bundles in a length direction to form a tape or strand shape by drawing and pressing fibers passed through an impregnation die supplied with a thermoplastic resin melt. Because of the substantially complete impregnation, the prepreg of the present system has improved mechanical properties such as sheet impact crack initiation energy, sheet impact energy, bending elastic modulus, bending strength, and Izod impact strength. In addition, because the prepreg has a tape or strand shape, the prepreg can be woven or laminated, and can be aligned

freely to the center layer. Furthermore, in the instant claims an additional hot press process for impregnation is not necessary, so the time for production of prepreg may be shortened.

On the contrary, according to *Sakai et al.*, it is difficult to make a uniformly impregnated polymer, that is, thermoplastic resin between glass fibers, because the prepreg is prepared using a conventional glass mat thermoplastic (GMT) process. In other words, substantially complete impregnation may not be possible. In addition, to improve the rate of impregnation in such a process, the time of the heating press would need to be increased. Accordingly, there would be a drawback in that the time of the process would therefore be extended (see Comparative Example 1 and Comparative Example 2-1 of the Application regarding the GMT process).

Further still, referring to Example 4 and Comparative Example 4 of the Application, a comparison of laminated sheet of Example 4 in which the sheet woven with the prepreg tape formed by substantially completely impregnating according to the present system, melt-laminated on both sides of the center layer, showed improvements in impact strength, linear thermal expansion coefficient, and similar bending elastic modulus, to the laminated sheet of Comparative Example 4, in which a glass fiber-resin composite layer formed by impregnating thermoplastic resin into glass fibers according to the conventional method was melt-laminated on both sides of the center layer, even though Example 4 had a lower glass fiber content than that of Comparative Example 4. In addition, Example 4 was lighter in weight, as the amount of glass fibers used was reduced, leading to a reduction in density (see Table 5 of the Application).

Accordingly, because *the continuous reinforcing fiber-impregnated prepreg layer is formed in a tape or strand shape by drawing and pressing fibers passed through an impregnation die supplied with a thermoplastic resin melt*, the instant claims are distinguished from the cited prior art and, further, this distinguishing feature leads to the improved properties of the present system referred to above (e.g., substantially complete impregnation, free arrangement,

and shorting of the process time). Particularly, the substantially complete impregnation provides improved mechanical properties, as is shown by a comparison of Example 1 with Comparative Example 1 and by a comparison of Example 2 with Comparative Example 2 of the Application. In addition, the substantially complete impregnation provides a thermoplastic composite sheet lighter in weight and with improved or similar mechanical properties, as is shown by a comparison of Example 4 with Comparative Example 4 of the Application.

Thus, the specification of the Application contains experimental data showing that the present invention as claimed is distinguishable based on the limitation that *the continuous reinforcing fiber-impregnated prepreg layer is formed in a tape or strand shape by drawing and pressing fibers passed through an impregnation die supplied with a thermoplastic resin melt.* For all the foregoing reasons, Applicants respectfully request withdrawal of the pending rejections and allowance of the claims.

CONCLUSION

The Applicants respectfully submit that the application, in its present form, is in condition for allowance. If the Examiner has any questions or comments or otherwise feels it would be helpful in expediting the application, the Examiner is encouraged to telephone the undersigned at (972) 731-2288. The Applicants intend this communication to be a complete response to the Office Action mailed June 19, 2009.

The Commissioner is hereby authorized to charge payment of any fee associated with any of the foregoing papers submitted herewith or any fees during the prosecution of the present case to Deposit Account No. 50-1515, Conley Rose, P.C.

Respectfully submitted,

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